

Final Report to NOAA Office of Global Programs

Project title: “Improving Climate Forecast Communications for Farm Management in Uganda”

Principal Investigators:

Jennifer Phillips, Associate Research Scientist,
International Research Institute for Climate Prediction
and Assistant Professor, Bard Center for Environmental Policy, Bard College

and

Ben Orlove, Adjunct Senior Research Scientist, Lamont Doherty Earth Observatory
and Professor, Department of Environmental Science and Policy, UC Davis

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I. Background Materials

Abstract

Interannual climate variability in eastern Africa is strongly influenced by the El Niño/Southern Oscillation, and the region is therefore a good candidate for implementing seasonal forecasts, especially regarding precipitation in the second half of the year. Despite the great climatological and agronomic variety in Uganda, nearly all farmers are highly rainfall dependent. In sum, there is potential for use of seasonal climate forecasts in Uganda. Yet this potential for use of forecast information is not being realized, partially as a result of a communication gap between the forecast-producers and the forecast-users.

Our project addressed this gap through the development of a series of radio programs in African languages that reached farmers with climate information that was relevant to local farming systems. Surveys, open-ended interviews, focus groups and the collection of weather-related narratives among Luganda- and Ateso-speaking farmers in central Uganda served as the basis for a set of radio programs. The field research team included a linguist, professional radio journalists, an agricultural meteorologist, and agricultural extension specialists to assure that the program material drew on the complex nuances of weather and risk descriptions in the local languages and that it met the local cultural expectations of information transmission in media. Above all, we sought to tailor the programs to the particular cropping systems that shape farmers’ needs and to the specific organizations in communities that permit information flow. In the course of our research, we found that farmers had a well-established cultural system of ‘signs’—empirical

forecasts for many areas of life, including weather. We drew on this language of ‘signs’ to explain the probabilistic and empirical nature of modern scientific forecasts. In order to improve opportunities for group discussion of radio program content and implications for farm management, we organized radio listening groups in a number of villages.

Surveys were conducted before and after the transmission of the radio programs to assess the level of access to the programs, perceptions of the programs, and use of information. We found evidence that programs did lead to wider use of forecasts in the communities. We note as well a positive effect of organizing the farmers into “listening groups” that met to hear the programs and then discuss them. In addition, there seem to have been some spillover effects; some government agencies and NGOs adopted the use of local languages for related projects in the communication of information for agriculture and for environmental management.

Project Objectives

Our primary goal was to use information about language, culture, access to media and farming systems to improve the communication of climate forecast information to farmers in Uganda, potentially providing a model to be used by the Met community in the future. To accomplish this, we

- performed field work, consisting of surveys, interviews and focus groups, to gather information;
- developed and aired a series of radio broadcasts, and set up a program of radio listening groups;
- evaluated effectiveness of radio programs through follow-up interviews and focus groups.
- conducted a workshop for personnel in the National Meteorological Service and the Ministry of Agriculture.

Approach to the Study

Our approach for data gathering was a combination of ethnographic, open-ended interviews, and quantitative surveys, performed by an interdisciplinary team. The team was composed of an agro-climatologist, journalists, a linguist specializing in African languages, and an extension agent. Two districts in different language groups were targeted for the set of data-gathering, broadcast, and evaluation activities over the three-year project. Keen interest and participation in field work and workshops by the Uganda Meteorological Service are believed to contribute to sustainability of the communications activities after the end of the project.

Matching funds: Salaries of the two P.I.s for approximately 2 months per year are contributed in kind.

II. Accomplishments

Activities in the Project

Decision making context of the study: The international meteorological community has significant skill in forecasting the development of El Niño events in the Pacific, which in turn are correlated with precipitation anomalies in Uganda. We sought to improve the Ugandan farmers' understanding of uncertainties and to extend their use of probabilistic information in planning. We sought sufficient flexibility in planning the details of our activities to adapt to the varying circumstances year to year.

By July of 2002, the international meteorological community recognized that an El Niño event was developing providing us with a unique communications context in which to study the impact of our efforts. This situation was different from the other years, with weaker anomalies. In addition to our communications campaign, many other information sources in 2002 were disseminating news of El Nino and potential impacts, including government agencies, NGO's, and private radio and newspaper sources. This is likely to mean that we cannot fully separate out the effects on farmers of our program from the effects of other new sources of climate information. However, such issues frequently face applied science interventions. Given the fact that the most recent experience people had with El Nino was the devastating 1997/98 event, in which severe flooding took place in many areas of Uganda, our message of caution was appreciated. Given our goals and this particular context, our evaluation emphasized decisions made in response to information rather than how much respondents knew about the forecast. The post radio program survey was conducted with 122 respondents across ten villages in Nakasongola District in October of 2002, to assess impacts of exposure to the radio program. In addition to this quantitative data collection, a series of four focus groups were held in January 2003 in which further assessment of the degree of perception of probabilistic quality of forecasts. We continued to broadcast programs in Nakasongola in 2004, and to conduct evaluations, though on a smaller scale. We added a second field site, in Kumi District, in 2004 as well. We conducted focus groups and pre- and post-program surveys there also.

Establishing Contacts with Ugandan researchers, farmers and other organizations:

In setting up this project, Phillips contacted two Ugandans whom she had met at Climate Outlook Forums for the Greater Horn of Africa. These were Patrick Luganda, a senior features writer for *New Vision*, the leading daily newspaper in Uganda, and Paul Isabirye, a meteorologist at the Ugandan National Meteorological Service. Isabirye had completed a B.Sc. in Physics at Makerere University, and, with support stemming from contacts made at the COFs, a M.Sc. in agrometeorology. These areas--communication (journalism) and in agrometeorology—were precisely the ones we needed, and it was fortunate indeed that Phillips knew these two individuals, and that they had already collaborated on a number of projects. They, in turn, contacted three other people with complementary skill. : Merit Kabugo is a linguist in the Departments of African Languages and of English at Makerere University, the leading university in Uganda, with an M.Sc. in Linguistics from that university. He has great familiarity with a number of the different languages spoken throughout Uganda, and has conducted research on different forms of persuasion. Sarah Kataike was an agricultural extension specialist,

having worked with farmer cooperatives; she was studying for her M.Sc. in Agricultural Extension at Makerere University at that time. Joyce Tabingwa was a radio journalist, with specializations in programming for farmers and for women; she had completed a number of special courses and workshops in Uganda and elsewhere in East Africa.

Selection of languages and field sites: The study was conducted in two districts in Uganda, Nakasongola and Kumi (Fig. 1)

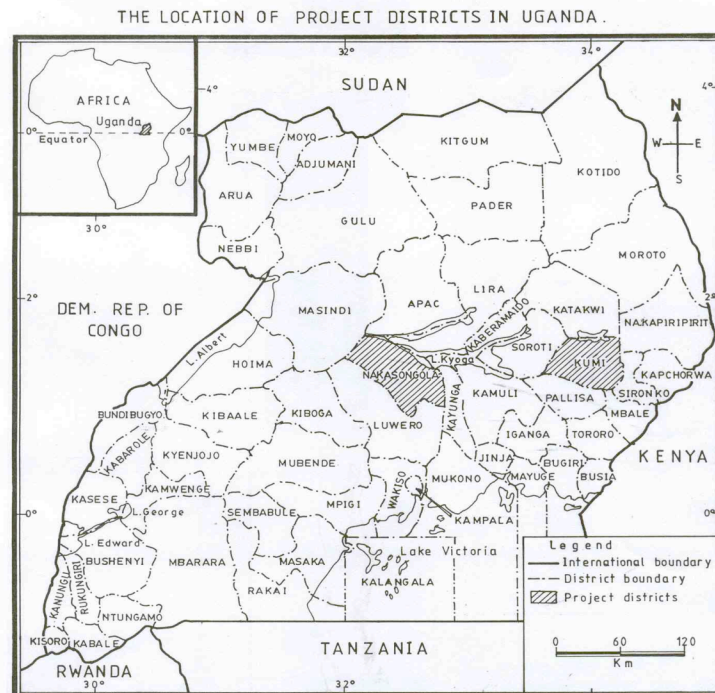


Figure 1: Field Sites in Uganda

Field sites within each district were selected to represent a range of agroecological zones and associated farming systems. Rainfall is bimodally distributed in both sites but tends to unimodal at the northern fringes. In Nakasongola (Fig. 2) the three subcounties were chosen along a north-south transect spanning a range of rainfall, lowest in the north and increasing toward the southern part of the district.

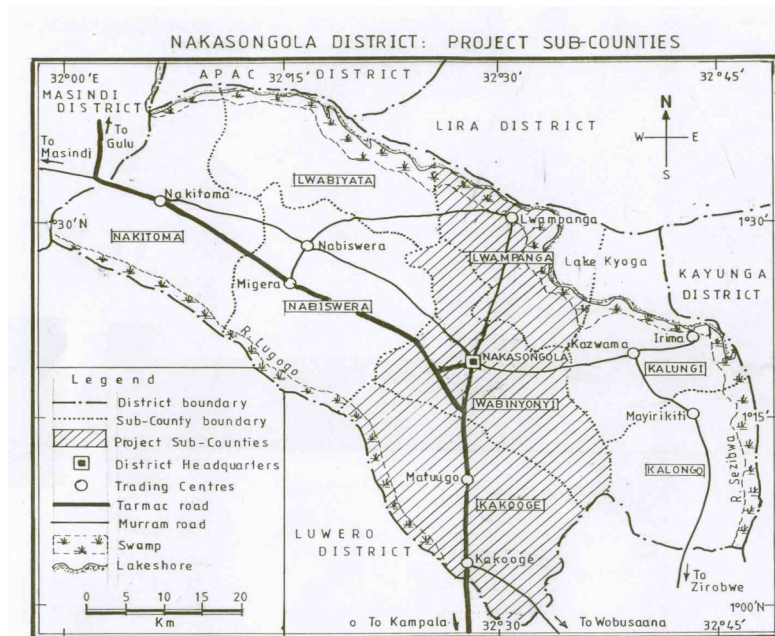


Figure 2: Specific Field Locations in Nakasongola District

The predominant language in Nakasongola is Luganda, which is the first language of people in the central region of Uganda and widely spoken throughout the rest of the country, particularly in the western and eastern regions. It presented a number of advantages: the Ugandan members of our research team spoke it, extensive written materials were available for it to support the development of radio programs and survey instruments, and a number of announcers at radio stations fluent in Luganda could collaborate on radio programs. It is the mother language of the linguist in our team; the agro-meteorologist, the journalist and the radio announced all acquired a closely-related language, Lusoga, as their first language but learned Luganda as children. The agricultural extension specialist grew up speaking Lugwere, another related language, but one with some affinities to other languages; she, too, learned Luganda as a child. Nakasongola is one of the driest portions of Buganda (the territory of the Baganda, or Luganda-speakers, in central southern Uganda). Since farmers in this district are particularly sensitive to periodic drought risk and hence were more likely to wish to participate in a climate communications project.

In Kumi District, the southernmost region of the Ateso-speakers, and the second site in which we worked, the three sub-counties were distributed at a distance from the main town of Kumi (Fig. 3). Rainfall here is lower in general than in Nakasongola, markets for agricultural produce less well-developed, and livestock plays a more important role in livelihoods. Ateso, the second language we chose, spoken in four districts in east-central Uganda. This language is completely unrelated to Luganda. The Iteso (as the speakers of Ateso are known) have had a very different history from the Baganda. They have been involved in settled agriculture for less than a century, where the Baganda have lived in permanent settlements and practiced agriculture for at least 600 years; the Iteso have lower rates of literacy and a lower proportion of urban population, so they have less exposure to government services in general. Their responses to scientific forecasts might

therefore be different. Moreover, several trained professionals were available to work with the project. These include the lead representative of the agricultural extension service in Soroti, the largest town in Teso (the country of the Iteso), a journalist who is also a language specialist fluent in Ateso, and a radio announcer for the *Voice of Teso* radio station. This group was assembled by our team managers Patrick Luganda and Paul Isabirye.

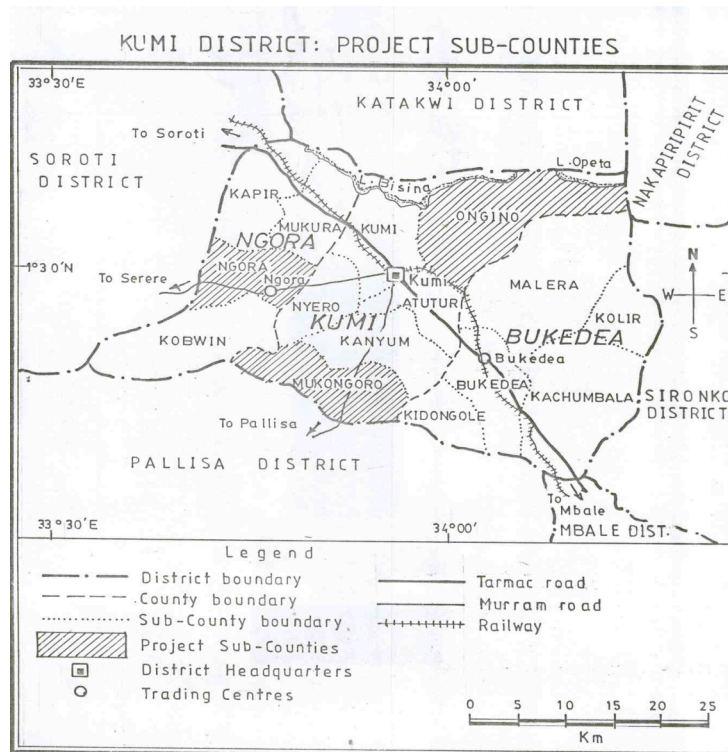


Figure 3: Specific Field Locations in Kumi District

Reconnaissance work and focus groups in each field site: Initial contacts were made with officials and farmer groups in each site selected. Step one in data collection was the design and implementation of a quantitative survey to assess demographics, farming systems, knowledge of climate impacts on farm operations, local language terminology for agro-climatological phrases, sources of climate information and radio access. In Nakasongola, 122 people were interviewed, with 65% citing farming, and 32% fishing, as their primary activity. Coffee, maize, beans, cotton and groundnuts were the most frequently cited crops in Nakasongola. In Kumi, of the 150 people surveyed, 100% consider themselves farmers. Of these Kumi farmers, 73% own livestock and 15% also fish regularly. Cassava, sorghum, millet, maize and cotton are the primary crops grown. The differences in main activities and crops grown reflect both the better climate for production in Nakasongola and the greater access to markets compared with the Kumi population.

In addition to the quantitative survey, focus groups were held in each district. Typically these included approximately 25 people, both men and women, and allowed for discussion around a set of topics related to local beliefs and history regarding climate

variability, climate change, and use of forecasts, both indigenous and from the Met Service. All of the group discussions were taped, and some material was then used in the radio broadcasts that followed. All the discussions were transcribed into English and added texture to the quantitative data collection.

Development of radio programming: The content of the radio programs in both Luganda and Ateso languages was developed using the results of the data-gathering activities performed in each district and language group. The general objective was to add both breadth and depth to the understanding of climate and climate variability/change in general, and to associate commonly understood beliefs about prediction as a tool for interpreting one's world with prediction presented by the Met Service. The assumption was that by elevating the level of dialogue regarding climate issues in the community, the ability to critically process and wisely utilize seasonal climate forecasts would be enhanced. Topics included in program development were:

- . seasonal and interannual variability
- . “signs,” referring both to the customary indicators or predictors in the local cultures (e.g., a bee buzzing in a room means that a guest is about to arrive) and signs environmental variables observed used by the Met Services (e.g., sea surface temperature)
- . uncertainty and risk: when you see a sign, you are not necessarily certain that some specific outcome will occur. (e.g., you might hear an owl hoot at night, a sign that someone in the extended family will die, but it might happen that a death does not follow this sign)
- . local agricultural, livestock and agro-livestock systems and management
- . contrast of climate variability and climate change (El Niño vs. global warming)
- . discussion of the current seasonal climate forecast issued from the Met Service

In addition to the base of lecture-style presentation of information, the format of the radio program included:

- . taped interviews in the local language with farmers
- . discussion in the local language with people knowledgeable about science (Met Service staff, District Agricultural Officers, or extension workers, etc.)

For the broadcast in Luganda language in July and August of 2002, air time was purchased from Radio Uganda, the State-supported broadcasting service. The decision to broadcast via this channel was based on two factors: Our team already had contact with a Luganda-speaking radio journalist who had participated in the IRI-sponsored workshop on Climate Forecasts and the Media that was conducted in Uganda in 2001, and already had a program on Radio Uganda making her a familiar, trusted voice; and two, Radio Uganda was more widely listened to than many of the smaller Luganda radio channels available, according to our pre-radio broadcast survey. Radio Uganda was established by the British in the colonial period and has a long history in the country; its powerful signal reaches much of the country. The broadcast in Ateso in February and March of 2004 was aired on “Voice of Ateso”, an independent FM station, by a regular broadcaster who

worked closely with the team in the second phase of the work. It is representative of the newer FM stations that have sprung up in the last 15 years or so, often reaching a smaller region, and often broadcasting in languages with smaller numbers of speakers. In both cases, the journalist-collaborator joined the research team for a number of the focus group discussions that took place in the data-gathering phase before the broadcast.

Support of radio program via listening groups: Groups of volunteers were organized in a number of villages within range of the radio broadcast in each language to gather together and listen to the program each Sunday morning of the series, then discuss the information. Whenever possible, a member of the research team was present to help lead the discussion. Our objective was to strengthen the interpretation and relevance of the program to the lives of the villagers through these follow-up discussions and group process. These sessions were well-attended and it came to be considered a source of status to belong to a climate radio program listening group. In addition to improving comprehension by these listeners, we hoped that future discussions with others not present would lead to spreading of knowledge and understanding of the issues.

Post-radio program surveys: Though our results lend support to the view that our radio programs had a positive impact on farm management, this claim must be viewed with some caution, for several reasons. To explain the first and most serious question, we point to an analogy with the testing of new pharmaceutical products, in which placebos are given so that researchers can separate out the effect of taking a pill from the effect of taking a specific pill. In our case, we organized group meetings and met with farmers on several occasions, thus underscoring to them the importance of climate. (The significance of the white visitors to remote villages should not be underestimated.) We therefore cannot distinguish the effects of the radio programs themselves from the effects of our visits and group meetings; perhaps the latter were more important than the content of the programs themselves. Secondly, multiple messages from a number of sources were available to our survey population such that our results reflect improved knowledge and decisions resulting from all channels. To continue the medical analogy, it is as if we were testing the effects of a new pharmaceutical product at the same time that other health care interventions were taking place. Thirdly, the quality control of the surveys was not as high as it might be in several ways. We do not have detailed studies of household management before and after the radio programs, but rather only simple surveys, conducted off-farm. The pre- and post-program surveys used somewhat different wording to ask similar questions, so the differences in the two surveys may reflect a variation in the wording. The presence of a number of listeners at each interview (a fact of life in rural Africa) means that the surveys are not as “uncontaminated” as they might be in other settings.

Nonetheless, we do note some positive findings. There is a striking increase in overall in familiarity and comfortable discussion regarding El Niño and its implications. Compared to the panic witnessed in 1997/98, stemming partially from lack of understanding and partially from media hype, villagers appear to have a much more sophisticated perception of what ENSO means and how they can use this information in planning. Figure 4 shows the changes in several variables for one field site, Nakasongola, after the first year of radio programs. The percentage of villagers who reported that they listened to radio

forecasts increased, as did the percentage who stated that they used the forecasts. The third pair of bars indicates the percentage who state that they alter their choice of crops according to the forecast (the most frequent use); this figure also increased, suggesting that forms of forecast use have been shared by villagers after the programs. These rough quantitative measures support our more impressionistic view that the enthusiasm of the participants indicates that the format of radio listening groups is a useful one for adding value to the airing of a radio program alone.

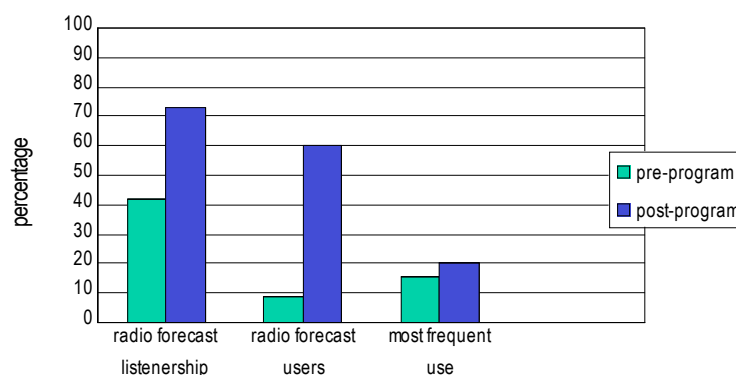


Figure 4: Changes in Forecast Activity After Programs

Spinoffs: Probabilistic thinking: Our presence in the field allowed for additional opportunities to gather data beyond the strict format required for radio program development. In each of the two field sites we conducted a series of focus groups specifically to test the hypotheses, often assumed by the climate forecasting community, that farmers and other non-scientists may not easily understand probabilistic forecasts. The objective of the meetings was 1) to place the discussion of Met service forecasts in the same mental “frame” as forecasts emanating from their culture, and 2) to elicit participants’ perceptions of uncertainty in outcomes of forecasts of environmental behavior.

Sixty-eight villagers in Nakasongola and 180 villagers in Kumi participated in a series of meetings in which the concept of prediction was discussed in a series of contexts. Discussion took place in the local language and made full use of the Luganda and Ateso terms for *signs* or *indicators*, to build a bridge between local and external concepts of prediction. After a brief introduction, villagers were presented with a commonly encountered prediction scenario – they asked to consider a forecast of the sex of an unborn child and common indicators used. They were then asked to indicate the chances that the child would turn out to be that which the indicator divined. They indicated chance by marking 10 dots on a piece of paper with pictures of a boy and a girl, distributing their “weights” according to the likelihood of the outcome. This exercise was repeated with scenarios for indigenous forecasts for a variety of weather events, and Met Service forecasts for a seasonal outcome.

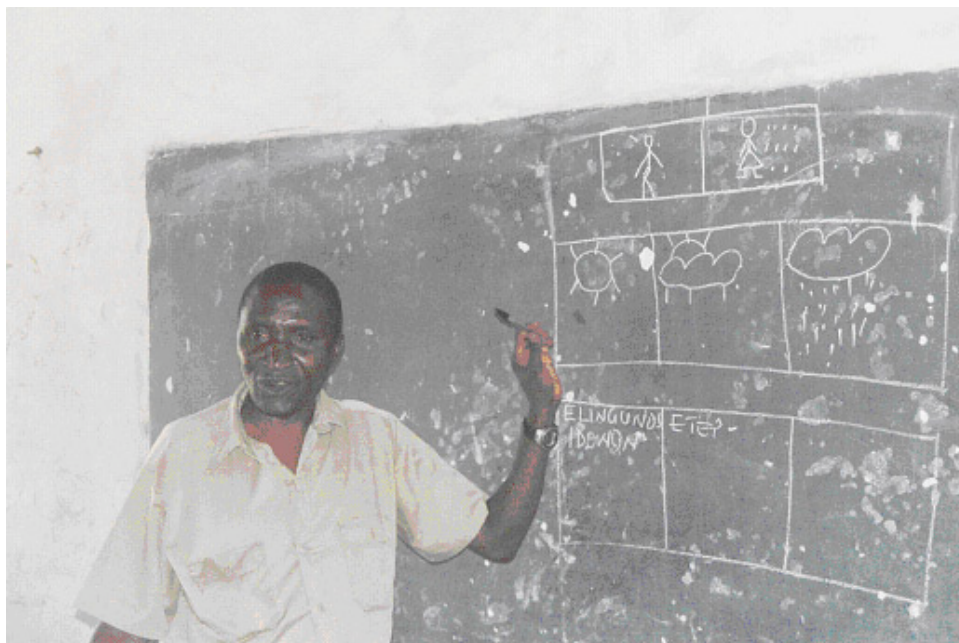


Figure 5: Explaining the Local Indicators
Kumi, July 2004



Figure 6: Participating in the Exercise on Local Indicators
Kumi, July 2004

Spinoffs: Climate and language across Uganda: Merit Kabugo, the linguist in the Departments of English and of African Languages at Makerere University, and Orlove have prepared two papers that represent spin-offs from the development of language materials. In the first, Orlove and Kabugo prepared a simple questionnaire to establish the

names of seasons in a sample of the languages spoken in Uganda; the number of languages lies between 40 to 45, depending on whether certain instances are counted as dialects of a single language or as two separate languages. Kabugo located students at Makerere who were native speakers of 24 of these languages, and provided them with copies of the questionnaire to take to their home districts on university holidays. These 24 languages represent all four of the major language families of Uganda. The results are striking: in areas with a unimodal (single peak) distribution of rainfall, the languages reckon two seasons, while in areas with a bimodal (double peak) distribution, they reckon four. In three instances on the border between these areas, the local languages count three seasons. This is illustrated in Figure 7, in which the numbers represent languages and the circles indicate weather stations. More specifically, the numbers 2, 3 and 4 in the figure each indicate a language with that number of terms for seasons; the open circles indicate weather stations with a unimodal, or two-season, pattern of rainfall distribution, while the closed circles indicate station with a bimodal, or four-season, pattern. Though this result seems intuitive, it has not been documented before. Moreover, it includes instances in which speakers of a language from a family that had two-season languages migrated into the region of bimodal rainfall distribution, and developed new terms to correspond to the local, rather than to the historical, circumstances.

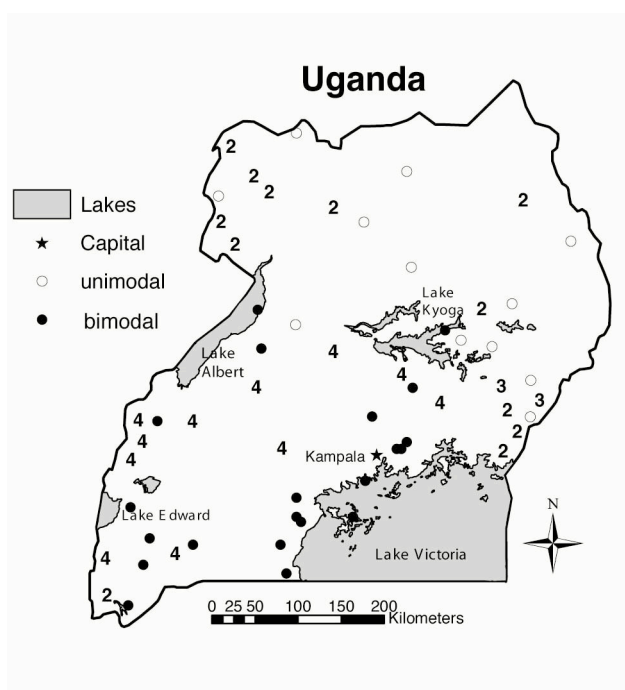


Figure 7. Seasonal Terminology in Local Languages in Uganda

In the second paper, Orlove and Kabugo explored the notion of ‘signs,’ called *obubonero* in Luganda. These are objects, entities or states that can readily be observed and that offer an indication that some event is about to take place, or about to be revealed to the public. To offer two examples, if someone sees a shooting star at night, that indicates that the person will soon acquire wealth; if an infant or toddler has a round spot on its body, that is a sign that the child’s mother is pregnant. These signs became a key element in our radio programs, since they served so well to explain two attribute of forecasts to the

farmers: their probabilistic nature (since signs are not guarantees, but merely likelihoods, of outcomes) and their empirical basis (since signs all rest on direct observation of phenomena, rather than deriving from oracles, dreams, or other non-naturalistic sources).

For a more detailed exploration of this cultural and linguistic practice, Kabugo collected 16 ‘signs’ for phenomena other than weather: health, economic well-being, the arrival of guests, and the like. He also recorded four conversations in which these signs were discussed. Like the weather signs, these signs are not esoteric knowledge, available to only a few who have access to special training or instruments, or to supernatural powers; they draw instead on the operation of ordinary senses—sight, hearing and touch, especially—in the public realm. In other words, these signs form part of the world of common sense. They are thus suitable topics for public discussion, since they are readily agreed upon. Though this finding, too, may seem intuitive, it contrasts sharply with much of the anthropological literature on African cultures, which emphasizes the operation of unseen forces and the central role of ritual specialists in interpreting good and bad fortune. This finding strongly supports the farmers’ assertion that they welcome listening groups, and is consonant with our observations of the broad participation in focus groups.

Final workshop: A final workshop was conducted outside Kampala in the Agricultural Research and Development Center at Mukono on July 5, 2004. Of the forty-two people joining the meeting, the almost half were farmers who participated in the study. Also in attendance were a number of representatives from the Uganda Department of Meteorology, journalists, both from the print media and radio, agricultural extension agents and representatives of NGOs. After presentation of project findings, breakout groups were formed to discuss recommendations to help bridge the gap between forecast providers and the user community. The meeting was a useful cap to the project overall.

Highlights of findings to date

Local use of forecasts: Our surveys indicate the virtually universal use of the traditional ‘signs,’ discussed above. About 70% of the farmers listen to radio forecasts from the Met Service, although this percentage varies by location and other variables. The farmers report a number of ways that they use these two sorts of forecasts, particularly in farm management, in planning for the movement and care of their livestock, and for protecting their houses against heavy rains.

Accuracy of local signs: We note three broad characteristics of the local signs used to forecast the onset of rains in our field sites, and, from short field excursions to other districts such as Masindi, Kabale, Iganga and Tororo, other parts of southern Uganda as well. Firstly, these signs are widely shared. In place after place, farmers mention that they look to shifts in the directions of prevailing winds (often with westerlies replacing easterlies); they note an increase in overnight minimum temperatures (as they report it, one wakes up feeling as if one wishes to bathe); they observe small localized whirlwinds, what are commonly known in English as ‘dust-devils’; they detect the return of a migratory bird, the Abyssinian horn-bill, *Bucorvus abyssinicus*, whose call is said to

sound like *gulu* ('heaven') or, more extensively, *gulu mpa nkuba* ('heaven, send rain'). Though farmers mention other signs as well, these four came up time after time in focus groups, surveys and informal conversation. Secondly, there may well be an empirical basis for each of these signs. Some researchers at the Ugandan Met service are undertaking research on this topic. The shift in prevailing winds often precedes the arrival of storm systems that carry moisture eastward from the Congo Basin. The warm nights can be associated with the movement of the ITCZ, and may be linked as well to increased humidity, and thus reduced radiative cooling, at these elevations of 1000-1500 m. The dust-devils are associated with local pressure differentials, which in turn are linked to the heating of ground in the warm dry periods before the rains. Though little is known about the behavior of the hornbills, it is well-documented for other avian species that birds are sensitive to the movement of air masses and front, and will delay their departure on their migration until they detect air movement that will serve literally as tail-winds. Thirdly, these signs are as much regional as local. Farmers query each other, especially after one has traveled, about the arrival of rain and of rain signs in neighboring areas. If a farmer undertakes a journey, he or she will look to see whether clouds are visible in the distance, whether the ground is moist from recent rains, and so forth. In this way, farmers anticipate the arrival of rains not only from a set of plausible signs but also from the movement of rains across the country.

Probabilistic thinking: In analyzing the results of the group exercises on forecasts, we considered three measures of understanding that forecasts are probabilistic. The first was simply the percentage that stated that at least two outcomes were possible in the climate forecast scenarios. This figure is quite high, close to 90% overall. The second is seeing whether a participant stated that there was at least some possibility, greater than zero, of the occurrence of all three possible outcomes (rain, clouds or sunshine, granted a traditional forecast of rain; late, normal or early onset of rains, granted a modern forecast of late onset). The percentage of participants listing three possible outcomes for the traditional forecasts was 49% in Nakasongola and 58% in Kumi; the corresponding percentages for the modern forecasts were 55% and 78%.

These results reinforce two concepts: one that probabilistic thinking is part of everyday decision making among this population and is therefore not a new or difficult concept to them; and two, that an effective means of reinforcing the probabilistic nature of seasonal forecasts generated by the Met Service – i.e., by “scientists” – is to use familiar local forecasting schemes to frame information regarding Met Service forecasts. Given the acceptance of uncertainty in a wide variety of everyday predictions, uncertainty becomes easier to accept in scientific predictions when presented in the same setting, leading to appropriate contingency-based planning and decision making.

Social and Cultural Capital in Processing Climate Forecasts: We note that seasonal climate forecasts, produced by the Department of Meteorology, can be considered as a kind of investment of public, or state, funds with the goals of increasing gross national product (GNP) or assuring food security, by increasing the overall production of crops, livestock and fish. These public investments are allocations in equipment, other infrastructure and salaries that are required to produce and distribute accurate and timely

forecasts. Our research points to the two facts regarding this investment. Firstly, there is a considerable stock of social and cultural capital in rural Uganda that can complement this state investment. Secondly, this stock of social and cultural capital can be tapped more effectively by some types of forecasts than by others.

The social capital can be divided into four main categories: informal discussions, local meetings, listening groups and participation in media production. The informal discussions are the extensive discussions that take place in farm compounds, at trading centers, on *matatus* (informal vans and taxis) and other public transport, and along roads; farmers meet, share information about environmental conditions in their areas and adjacent regions, and discuss the prospects of conditions in coming weeks and months.



Figure 8: Group listening to one of the Luganda-language radio broadcasts on climate Nakasongola, July 2002.

The local meetings are often organized by Local Council leaders, NGOs, religious groups and civil society organizations; these, too, provide forums for evaluation of information. Listening groups consist of farmers who agree to attend a set of regular meetings in which they first listen to radio programs and then discuss their content. These three types of organization all allow farmers to find ways to understand and to apply forecasts more effectively than if they worked on their own; phrased differently, these are pre-existing social forms that can help convey forecasts to end-users, and thus substitute for state capital in distributing forecasts. The participation in media production consists of the actions of farmers to provide material for forecast dissemination, either by responding to interviewers or by calling in, usually via mobile phone, to radio stations; they substitute for state capital in preparing materials for disseminating forecasts.

The cultural capital consists of kinds of knowledge that allow farmers to comprehend and apply forecasts more readily than they otherwise would. In other words, they substitute for state capital in making forecasts readily understandable and usable. We note three main categories of this cultural capital. Seasonal terminology is well developed. As discussed elsewhere in this report a study of 24 of the 50 languages of Uganda shows a very close correspondence between the number of seasons reported in each local language (the numbers 2, 3 and 4 in the figure each indicate a language with that number of terms for seasons) and the number of seasons described by meteorologists (the open circles indicate weather stations with a unimodal, or two-season, pattern of rainfall distribution; the closed circles indicate station with a bimodal, or four-season, pattern).

Knowledge of climate indicators is extensive and sensitive to local variation, as shown by the signs (*obubonero* in Luganda, *aanyuneta* in Ateso) that farmers use to anticipate the timing of onset of rains and the amount of total precipitation in a given season. Finally, knowledge of the consequences of climate variability allows farmers to anticipate and mitigate the effects of such variability on crops, livestock, fishing and infrastructure, such as roads and structures.

This stock of social and cultural capital complements state investments in facilitating the distribution and use of forecasts. However, this complementarity varies depending on the form of the forecast. We note four aspects of forecasts that can influence this complementarity. Firstly, forecasts in local languages are more effective than those in English. Secondly, the particular media are important; radio forecasts seem more accessible than print forecasts, granted the limitations on distribution and on literacy. Thirdly, forecasts that draw on verbal formats familiar to farmers (with concrete examples, links to particular places and communities, and details of local life) are more accessible than those in unfamiliar formats (with abstract and technical information that remain unassimilated to local experience). Finally, forecasts that are distributed in time frames that correspond to farmers' schedules and habits are more effective than those that appear irregularly or at less convenient intervals; in particular, climate information integrated into weekly radio programs can reach regular listeners.

Contributions to Uganda

Improvements in forecast delivery: We believe this work has contributed to the improvement of forecast delivery in three key ways. First and foremost, the Uganda Department of Meteorology took a keen interest in the work and engaged in discussions and planning activities geared toward improved forecast products and services as a result. Our key collaborator, Paul Isabirye, is primarily responsible for the very positive relations we had with the Met Service. The importance of this connection was key to the success of the project and to sustaining this effort after completion of the project.

For example, air time has been offered to the Met Service on one of the major radio stations that the Met Service was considering using for climate discussion and forecast delivery in local languages, modeled after our program. Additionally, during the latter

term of our project, the Met Service has begun to produce regionally-specific monthly updates on the forecast in a print version, which they envision being distributed both via print media and translated for local-language radio. Incentives to produce this product stemmed initially from the RANET project but due to our work, the Met Service became increasingly aware of the importance of quality translation for local consumption. Overall, the collaboration of Met Service personnel in this work led to an increasing sensitivity to local language and cultural perspectives in climate product development. It is our understanding that the Met Service intends to continue developing vocabulary appropriate for translating the concept of “indicators” for additional languages to assist in forecast translation at the source where they can control product quality.

The second important contribution of this work was in raising the broader awareness of climate communications in Uganda. Climate has become a “hot” topic, due in part to the presence of this team on the ground. Paul Isabirye plays an important role in setting up exhibits at the National Agricultural Exposition held each July. This fair draws many participants from around the country and allows the diffusion of information. RANET, a program that delivers Met Service forecasts and information to computers installed in rural areas (via a satellite uplink and a rebroadcast to digital radios), is adding content in local languages in at least three of their twenty sites in Uganda. Several NGOs have also become interested in our work. Our ties to Oxfam have led directly to their use of local language; World Vision, an NGO that supports RANET in Uganda, has extended local language programs to several of its rural projects. And one of our project members, Sarah Kataike, became Uganda country director for the Hunger Project, and used local language forecast delivery as a way to address food security issues in several areas. After working with them for two years, she shifted to work with other NGOs, also involved in poverty alleviation and the extension of information. As noted earlier in this report, we can no longer isolate a “control” group of farmers who have not heard a radio program on climate, because indeed, everyone is talking about it. Although it is hard to measure our contribution to this phenomenon, we believe it has been significant.

The third contribution is in developing a core set of journalists who have a solid understanding of the basic concepts surrounding the science of the seasonal forecasts as well as the issue of application of forecasts to decision making. Patrick Luganda, our co-team leader along with Paul Isabirye, acted as the key liaison with the journalist community in Uganda. In addition to recruiting the radio announcers that participated in the radio programs, he has taken on the task of chairing the newly formed NECJOGHA (Network of Environmental and Climate Journalists of the Greater Horn of Africa). He will undoubtedly go on to facilitate and reinforce learning in the East African journalist community regarding climate forecasting and climate change for the purpose of improving reporting and increasing public awareness.

Development of key personnel: Beyond the outstanding job performed for this project by Patrick Luganda and Paul Isabirye, these two individuals have taken their experience with the project and translated it into an NGO that works on climate and development projects. The two are now registered as NGO, CODEV, Communications for Development; it works in communication of scientific and technical information in such

areas as environment, agriculture and health. Sarah Kataike, involved in the first phase of this work as an extension officer, later went on to become the country director for the Hunger Project. Merit Kabugo, the linguist from Makerere University, had the opportunity to travel to Austria to give a paper co-authored with one of the investigators, Orlove, in October of 2004.

Links to government agencies and NGOs: As discussed elsewhere in this report, our work has had a direct effect on the Met Service, and has influenced agricultural extension, particularly in our research districts. The use of local languages has continued on the national radio network. A number of NGOs have adopted local languages, some through direct contact with our project.

Local use of forecasts: Our surveys show that informants have strong access to radio (88% have access to radio, and 79% own their own radio) reinforcing our assumption that radio is a useful channel to utilize for climate information dissemination. We did not find strong differences between farmers, fishermen and traders with respect to radio access. They listen primarily to news and announcements (79%), with 47% reporting that they listen along with family members rather than alone, providing a context for discussion and processing of information. A large proportion (72%) state that they listen to climate forecasts on the radio

The number of reported uses of forecasts increased from the pre-program surveys to the post-program surveys. In the former, a smaller number of agricultural uses were mentioned; in the latter, more agricultural uses were mentioned, and uses were mentioned as well for livestock (e.g., preparing for animal diseases) and for other household activities (e.g., altering firewood collecting). Respondents indicated that climate information was used at both the household and the community level, with activities such as road repairs and clearing of ditches mentioned.

Though these results lend support to the potential positive impact of our radio program intervention, they do need to be taken with some caution, for several reasons. We do not have detailed studies of household management before and after the radio programs. The pre- and post-program surveys used somewhat different wording to ask similar questions. The presence of a number of listeners at each interview (a fact of life in rural Africa) means that the surveys are not as “uncontaminated” as they might be in other settings. Moreover, the changes may reflect not only the effects of listening to the radio programs, but also the consequences of meeting with the research team over a longer period. Finally, as noted elsewhere, multiple messages from a number of sources were available to our survey population such that our results reflect improved knowledge and decisions resulting from all channels. Viewing this from a positive perspective, we noted a very striking increase in overall familiarity and comfortable discussion regarding El Nino and its implications. Compared to the panic witnessed in 1997/98, stemming partially from lack of understanding and partially from media hype, villagers interviewed in this year of fieldwork appear to have a much more sophisticated perception of what ENSO means and how they can use this information in planning.

Network of organizations: We note an expansion of the network of organizations that make use of local languages for forecast dissemination (see illustration in Figure 9). RANET, a program that delivers Met Service forecasts and information to computers installed in rural areas (via a satellite uplink and a rebroadcast to digital radios), is adding content in local languages in at least three of their twenty sites in Uganda. Several NGOs have also become interested in our work. Our ties to Oxfam have led directly to their use of local language; World Vision, an NGO that supports RANET in Uganda, has extended local language programs to several of its rural projects. And one of our project members, Sarah Kataike, became Uganda country director for the Hunger Project, and has used local language forecast delivery as a way to address food security issues in several areas. We are glad to see this expansion. It does mean, though, that we cannot test as accurately the effects of our radio programs alone, because many subjects may have heard forecasts in local languages through other channels.

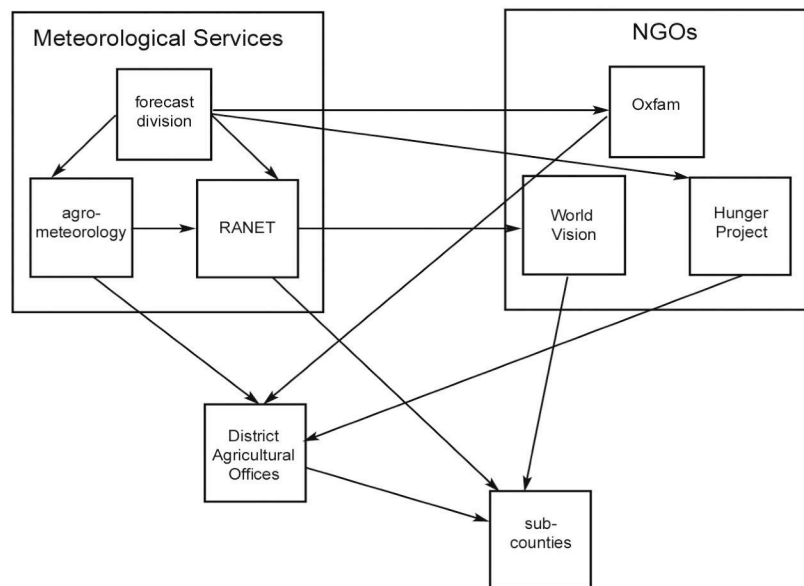


Figure 9: Networks of Climate Information Communication Emerging in Uganda

Papers, presentations based on research results

An oral presentation “Ugandan Farmers’ Perceptions of Climate in Farm Management” was made by Phillips at the American Society of Agronomy Annual Meetings in November of 2002. Also, preliminary material is included in an ethnoclimatology database that Ben Orlove is developing in association with CIESIN. It has served to develop a questionnaire on traditional climate knowledge that Orlove and his graduate students are currently testing in several different settings.

Orlove has presented material from this project at talks at Stanford University, the University of Chicago, and at the University of California, Berkeley. Data gathered for this project also is included in an article on seasonal terminology, “How people name

seasons,” a chapter in a book *Weather, Climate, Culture*. Sarah Strauss and Ben Orlove, eds. 2003. Oxford: Berg. Weather, culture, climate. Pp. 121-140. Orlove has also included material on traditional weather signs in Uganda in an article Orlove, Chiang, and Cane, 2002. Ethnoclimatology in the Andes. *American Scientist* 90:428-435. Phillips presented an invited paper “Improving Climate Forecast Communication for Farm Management in Uganda” at the Association of American Geographers Annual meeting in March 2003. A paper entitled “Living with Uncertainty: Approaches to Improve Decision Making using Probabilistic Climate Information in Uganda” has been submitted for review to be presented at the Human Dimensions of Global Change meetings in Montreal in October 2003 by Phillips.

Significant deviation from original plan

We requested, and received, a no-cost extension to the project, to extend the project end date from July 31, 2003 to July 31, 2004. The need for this extension was the result of our late start, necessitated by the move of the project setting from Zimbabwe to Uganda in the first year, following the deterioration of public security in Zimbabwe. As a result of delays, we will now only address a complete cycle of activities in two language groups.

III. Interactions

Interactions with decision makers:

This project is designed specifically to link the Met community with agricultural extension and farm-level decision makers. By improving understanding of the decision-making context of the end-users of climate information, communications products can be designed to fit smoothly into the decision process. A majority of the project activities are performed in direct contact with village-level farmers, village leaders, and the extension agents who serve them. This interaction includes the facilitation of radio listening groups providing a context for farmers to discuss climate information and possible uses appropriate to their farming constraints.

The existing pattern of communication between the Met service and the farmers is unidirectional and limited. The upper image of the pair in Figure 10 suggests how the Met service sends forecasts (as text written in English) to district agricultural officers, who present the forecast to their extension workers; the latter, if time and money permit, travel to visit farmers and speak to them of the forecast. The lower image suggests our plan: to translate the forecasts into local languages and disseminate them by radio, reaching a much larger percentage of the overall population more quickly, in a form that is more accessible culturally and linguistically.

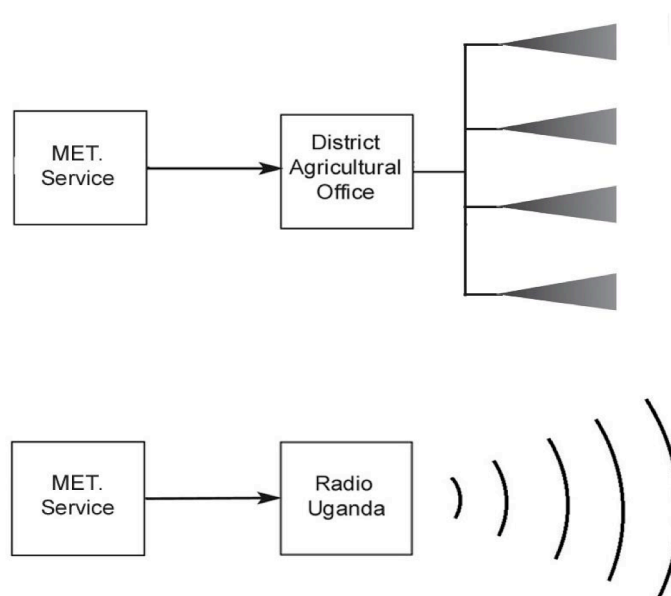


Figure 10: Alternate Models of Forecast Communication

As the image in Figure 11 indicates, our programs entail communication between forecast-users and forecast-producers in several ways. The meetings associated with preparing the programs allow for forecast-users to meet with radio journalists and even with some Met service people; the taped interviews and call-in programs also allow for communication to flow back from forecast-users to the Met service. The surveys also provide for assessment of the perceptions, activities and satisfaction of the forecast – users.

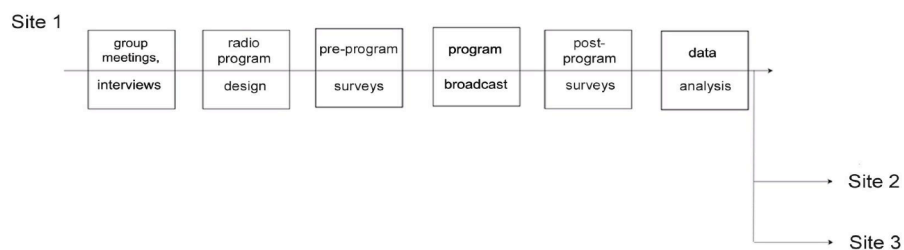


Figure 11: Sequence of Activities in Communications Program

Interactions with climate forecasting community:

In addition to having a senior scientist at the Uganda Met Service as one of our two project managers, the project team has numerous activities in conjunction with representatives of the meteorology and climate community in East Africa. First, we specifically designed into the project a series of formal meetings between the team and the Ugandan Met Service in which updates and exchange of ideas are provided. These meetings allow opportunities for the team to reinforce fresh perspectives among the Met employees on rural communities' needs, use and understanding of climate products, as well as serving to educate those on the team about climate issues, concerns and the latest forecast interpretations. In addition to formal exchanges, our team members now regularly drop in on the Met Office for updates and casual communication.

The second primary forum for interaction between the project team and the Met community is via attendance at the Regional Climate Outlook Forums of the Greater Horn of Africa. The GHACOF of March 2003 was conducted in Entebbe, which was particularly fruitful for exposure for our project. Patrick Luganda, the lead journalist on our team, conducted a workshop for Ugandan journalists in conjunction with the COF, specifically on communicating climate forecast information. As a result, 18 lead journalists in Uganda were able to participate in the regional climate outlook meeting. We feel extremely fortunate to have been able to contribute to his enhanced experience on the topic and that he has the initiative to share his knowledge with the media community at large.

Interactions with other NOAA CSID divisions

Our primary interaction with other NOAA Human Dimensions researchers has been through the numerous meetings sponsored by NOAA OGP. The Human Dimensions PI's meeting held in October of 2002 was attended by both Orlove and Phillips. Additionally, Phillips made a presentation at the Annual American Association of Geographer's meeting held in New Orleans in March of 2003, in the special session "Communication of Climate Forecast Information to Decision Makers", sponsored by OGP. This was another useful opportunity to interact with other researchers working on the topic of communicating forecasts, as well as providing exposure to the wider Geography and Global Change research community.

IV. Relevance to the field of human-environment interactions

How our results are relevant to the field

These results suggest that communication is a critical matter for forecast dissemination and use. The farmers develop a better understanding of forecasts and use them more as a result of the process of research, program development and assessment; they respond

positively to the programming in the local language and to the listening groups. This project shows the importance of thinking of communication as an ongoing process rather than as a series of brief events of information dissemination; it demonstrates the need to adapt forecasts to specific circumstances. We note as well that the community brings considerable resources to the project. These resources include the existence of group processes for evaluating new information; indigenous knowledge about climatology, climate variability, and local indicators; a perceived need for reasonably reliable (though not deterministic) forecasts.

How this work builds on previous HDGEC findings

This project builds on one of the P.I.'s (Phillips) previous findings in the Zimbabwe context in which it was evident that forecast adoption does not follow easily from the presence of forecast information by itself. This theme is present in the main thrusts of other HDGC researchers in their work with small holders in West Africa, Brazil, southern Africa and the Andean region. In addition to the constraints observed in forecast use by small holders, or specific social groups such as women, challenges to improving communication continue to be noted in almost all these research groups.

Our contributions to the field:

We are beginning to develop knowledge regarding the ways in which climate information and knowledge matters for this subgroup of end users in rural Uganda. This foundation has contributed to the content and expression of climate information messages that are developed by the Uganda Meteorological Service and by several NGOs, and has facilitated the comprehension and utilization of information for the users themselves. Through this work, we seek to demonstrate the importance of understanding user contexts in developing climate-related communications. Increased interaction provides opportunities for information to flow from the farm household back to the Met community, allowing for targeting of new areas of research more relevant to the needs of the users.

Three areas in particular are advanced by this work. First, we show that forecast-users and Met Service personnel can work within a framework that connects local perceptions of climate forecasts with 'scientific' understanding of climate forecasts. Both groups are aware of the probabilistic nature of forecasts and of the existence of regular natural features that serve to forecast climate variability. Secondly, we find that the end-users seek to draw on existing contexts in local society to assess new forecasts; in the case of Uganda, radio listening groups have proven useful, but other forums might be appropriate in other cases. These groups facilitate discussion between decision makers (in our case, farmers) on the topic of the role of a particular forecast in farm or livelihood management in improving decision making through evaluation of the radio listening groups. Third, we find that our project is embedded in a dense network of government agencies and NGOs; these other actors serve to spread parallel projects in Uganda.

Taken as a whole, these contributions suggest that considerable resources in the form of knowledge, organization and perceived needs exist within Uganda that have facilitated our communications project. Such resources are likely to exist in other regions in the developing world as well.